

REMARKS

Presently claims 31-57 are pending in this application. Claims 33 and 34 have been amended, but no new subject matter has been added. Claims 31 and 44 are independent. Applicant thanks the Examiner for noting that claim 38 is allowable. Applicant respectfully traverses the Rejections/Objections, which are discussed below.

Claim Objections

Claims 33 and 34 have been objected to because the Office contends that the values recited in these claims are not ratios because they have dimensions. Applicant has amended claims 33 and 34 so as to obviate the Office's objections. Applicant, therefore, respectfully request the withdrawal of the objections to claims 33 and 34.

Claim Rejections under 35 U.S.C. § 103

Claims 31-34 and 39-43 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,616,067 to Goenka ("Goenka"). Applicant respectfully disagrees.

For example, Claim 31 is patentable over Goenka because Goenka fails to disclose or render obvious each and every element of the claimed invention. For instance, Goenka fails to disclose or render obvious a method for cleaning surfaces, wherein "the CO₂ is introduced from the expansion volume (34) into the blasting line (10) upstream of the blasting nozzle (14)," as is required by claim 31.

The Office contends that Goenka discloses an expansion volume, but it does not. (*See* Office Action at 2). Instead, Goenka is directed to an apparatus for cleaning a work piece with abrasive CO₂ particles. (*See* Goenka at Col. 1, lines 6-7.) Goenka discloses that

the feed-line 21 carrying the liquid CO₂ from the reservoir is coupled into the tapered, annular CO₂ plenum or manifold 22 of decreasing cross-sectional area that provides liquid CO₂ under equal pressure into four CO₂ channels 24a, b, c and d. Each of the four CO₂ channels opens into a section of the converging section 10 of

the nozzle 60 through a CO₂ orifice immediately adjacent to the throat 20.

(Goenka at Col. 3, lines 11-20 (emphasis added)). In other words, CO₂ is supplied directly into the nozzle 30 downstream of the feedline 11 in a liquid state. Goenka not only fails to disclose the volume of an expansion chamber, but fails to disclose the existence of any sort of expansion chamber at all.

The embodiment of the present invention disclosed in claim 31, on the other hand, requires an expansion volume 34. (See Present Application at Fig. 1.) It is an important feature of the embodiment of the present invention disclosed in claim 31 that the liquid CO₂ is first introduced into an expansion volume 34 where it is allowed to expand and to solidify before being entrained by the rapid flow of the carrier gas. The CO₂ can then form particles, which are then introduced into the flow of the carrier gas in the blasting line upstream of the nozzle so that the particles can be accelerated further and dispensed in the carrier gas before they reach the nozzle. As would occur in Goenka, without the presence of an expansion volume, the liquid CO₂ would be diluted too rapidly in the carrier gas and could not form particles of a sufficient size. Accordingly, claim 31 is patentable over Goenka because Goenka fails to disclose a method for cleaning surfaces, wherein “the CO₂ is introduced from the expansion volume (34) into the blasting line (10) upstream of the blasting nozzle (14),” as is required by claim 31.

Applicants, therefore, respectfully request withdrawal of the rejection of claim 31 and of claims 32-34, and 39-43, which depend from claim 31.

Claims 35 and 36 were rejected under 35 U.S.C. § 103 as being unpatentable over Goenka in view of U.S. Patent No. 5,184,427 to Armstrong (“Armstrong”). Applicant respectfully disagrees.

Claims 35 and 36, which depend from claim 31, are patentable for at least the same reasons as mentioned above with respect to claim 31. Claims 35 and 36, however, are also patentable for the additional reason that neither Goenka nor Armstrong alone, or in combination, teach or render obvious the elements of claims 35 and 36.

As the Office correctly suggests, Armstrong is directed to a carbon dioxide blast cleaning system. Dry-ice pellets are supplied from a hopper and fed into a blast unit and into a blast gun. (See Col. 3, lines 4-19). While Armstrong discloses a “suitably insulated” storage hopper (See Col. 3, lines 63-65), it fails to disclose insulating any other portion of the blast cleaning system. Armstrong does not teach or render obvious a blasting method wherein “the expansion volume is thermally insulated from the environment,” as claim 35 requires, nor does Armstrong teach or render obvious a blasting method wherein “the portion of the feed line adjacent to the expansion volume is also thermally insulated from the environment,” as claim 36 requires. Accordingly, even if the disclosure of Goenka were combined with the disclosure of Armstrong, the combined disclosure would still fail to teach or render obvious all of the elements of claims 35 and 36. Applicant, therefore, respectfully requests withdrawal of the rejections of claims 35 and 36.

Claim 37 has been rejected under 35 U.S.C. § 103 as being unpatentable over Goenka in view of U.S. Patent No. 5,785,581 to Settles (“Settles”). Applicant respectfully disagrees.

Claim 37, which depends from claim 31, is patentable for at least the same reasons as claim 31. Even if claim 37 were not patentable for the same reasons as claim 31, however, it would be patentable over Goenka in view of Settles because Settles fails to make up for the deficient teachings of Goenka; neither Goenka nor Settles, alone or in combination, teach or render obvious all of the elements of claim 37. For example, neither reference teaches or renders obvious a blasting method characterized in that “a deposition of solid dry ice at the walls of the expansion volume (34) and/or the blasting line (10) is caused by swirl edges (40) in the expansion volume or at the downstream end thereof,” as is required by claim 37. The Office incorrectly contends that Settles teaches this feature of claim 37, but it does not.

Settles discloses an abrasive ice-blasting apparatus. (See Col. 3, lines 8-20). The ice used in the apparatus is produced near the blast nozzle by exposing fine droplets of water to cold gas. (*Id.*). The fine droplets of water are achieved through use of an atomizer. (See Col. 7, line 51 – Col. 9, line 37). Settles discloses using a pressure-swirl atomizer, which imparts swirl to the liquid inside the nozzle with the result that the liquid exists as a thin, conical, swirling sheet that breaks up into droplets due to the combined action of liquid instability and aerodynamic forces

due to interaction with the air stream. (*Id.*). The liquid water droplets are then frozen by exposing them to cold gas. (*Id.*). In short, the swirl atomizer of Settles atomizes liquid water prior to it being frozen.

By contrast, according to the present invention,

the grooves of the internal threading 40 also act as swirl edges. These swirl edges cause the dry snow forming in the expansion volume 34 to swirl, and especially the internal threading 40 promotes the adhesion of dry snow at the walls of the branch 24, so that a relatively compact but brittle crust 46 of dry ice is formed in the expansion volume and to some extent also in the blasting line 10. The CO₂ which is sprayed out of the feed line 32 and is evaporated thereby forces its way through the crust of dry ice. This CO₂ and the carrier gas flowing at high speed through the blasting line 10 and past the crust 46 permanently erode small particles of dry ice from the crust. These relatively coarse and hard particles then form a very efficient blasting material by which a high cleaning effect of the blasting apparatus is achieved.

(Present Application at [0052])). In other words, the swirl edges of the present invention do not serve to atomize liquid water, but to accumulate frozen CO₂, which is then broken off in coarse hard particles to form a very efficient blasting material. Settles simply does not disclose this or render it obvious. Accordingly, even if the disclosure of Goenka were combined with the disclosure of Settles, the combined disclosures would still not include or render obvious a blasting method characterized in that “a deposition of solid dry ice at the walls of the expansion volume (34) and/or the blasting line (10) is caused by swirl edges (40) in the expansion volume or at the downstream end thereof,” as is required by claim 37. Applicant, therefore, respectfully requests withdrawal of the rejection of claim 37.

Claims 44-57 were rejected under 35 U.S.C. § 103 as being unpatentable over Goenka in view of U.S. Patent No. 5,785,581 to Settles (“Settles”). Applicant respectfully disagrees.

Claim 44 is patentable over Goenka in view of Settles because neither Goenka nor Settles, either alone or in combination, discloses or renders obvious each and every element of claim 44. For instance, neither reference discloses or renders obvious “a feed line 32 for liquid CO₂ which opens into an expansion volume (34),” as is required by claim 44. The Office

contends that Goenka discloses this feature, however, as discussed above, Goenka does not. Furthermore, Settles fails to make up for the deficient teachings of Goenka. Accordingly, claim 44 is patentable over the cited reference because they fail to disclose or render obvious each and every element of claim 44.

Applicants, therefore, respectfully request withdrawal of the rejections of claims 44, and of claims 45-57, which depend from claim 44.

Claim 38 was objected to as being dependent upon a rejected base claim, but held to contain allowable subject matter. In view of the above remarks, allowance of claim 38 is respectfully requested.


CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding objections and rejections, and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

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In re: Jens Werner KIPP
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If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Respectfully submitted,

By: 
George R. Repper
Attorney for Applicants
Registration No. 31,414
ROTHWELL, FIGG, ERNST & MANBECK, P.C.
Suite 800, 1425 K Street, N.W.
Washington, D.C. 20005
Telephone: (202) 783-6040